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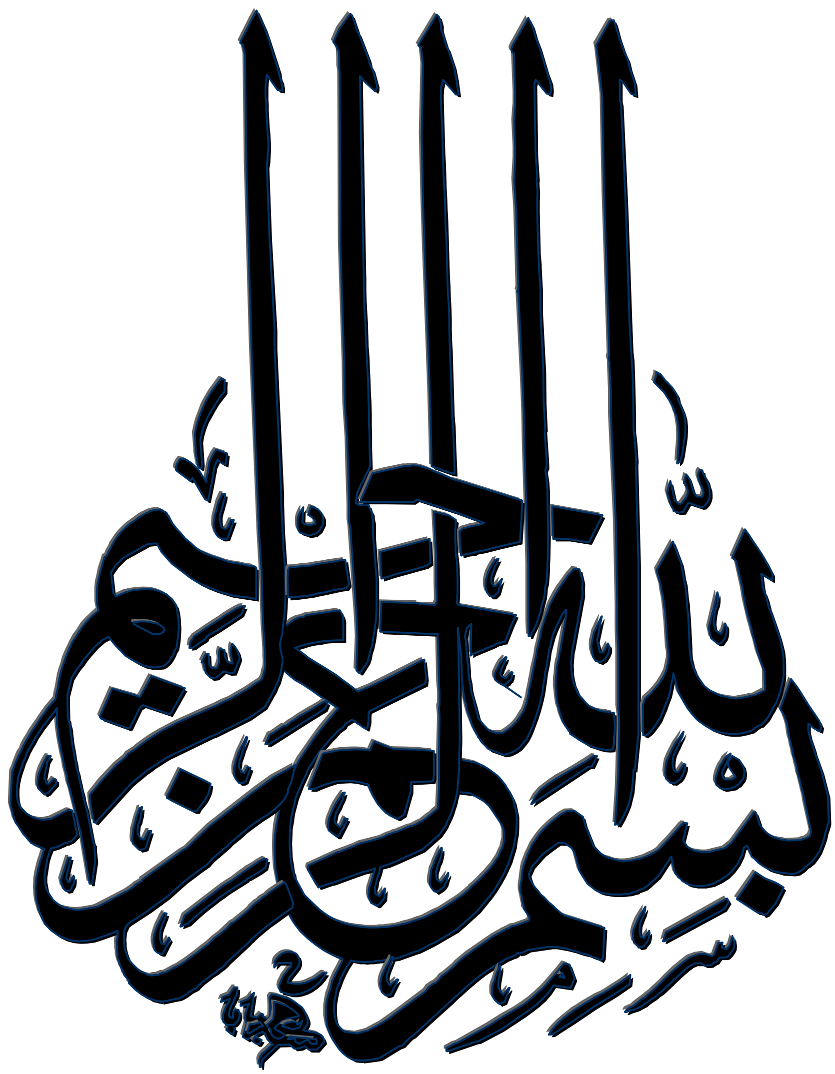
بسم الله الرحمن الرحيم

THE INFLUENCE OF LOAD AND THERMAL CYCLING ON MARGINAL ADAPTABILITY AND GAP DISTANCE OF PACKABLE COMPOSITES

Thesis
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"Dedicated to my loving parents, supporting husband and my dear daughter"

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The main aim of restorative dentistry is to replace diseased or lost tooth structure with materials that restore both function and appearance. Since almost 45 years the resin composites were introduced and became a popular choice for tooth restoration and its general use has been for class III, IV and V. Recently with more interest in esthetics and alternative to dental amalgam to avoid the possibility of mercury toxicity, the use of many types of resin composite as a posterior restoration has expanded to restore class I and class II in posterior teeth.

The marginal seal or adaptation of a restorative material to cavity walls is a major factor for the long-term performance of any restoration. Approximately 30% of restorative replacements are attributed to microleakage**.** It is the main cause of marginal stain, post operative sensitivity, recurrent caries and possibly pulpal problems

Moreover teeth are subjected to heavy occlusal forces during normal function and parafunction and when these occlusal forces are exerted on a tooth, stresses will be distributed through out its structure**.** Such stresses have been reported to dislodge restorations at the cavosurface margin ***(Van Merbeek et al, 1993).*** In addition, load cycling could adversely affect the marginal integrity of resin composite restorations unless a hybridizing adhesive system is used ***(Abdallah and Davidson, 1996).***

Additionally dental restoratives are subjected to constant and extreme changes in the oral environment brought about by fluctuations in temperature and Ph. Thermally induced stresses that may lead to gap formation and microleakage at the interface are a result of the mismatch of the coefficients of thermal expansion between the restorative materials and natural tooth structure ***(Nalcai and Ulusoy, 2007)*.**

Nowadays, flowable and packable resin composites have been introduced for restorative purposes. Flowable resin composite has low filler loading that results in a material with low Young's modulus which provides some material elasticity, thus it can be used as a liner in class II cavities. This unique property of flowable composites may help in reducing marginal stress during the life time of a restoration ***(Unterbrink & Leibenberg, 1999).*** Moreover, this formula results in a material that has low viscosity, high fluid injectability into cavities and better adaptation to cavity walls thus reducing microleakage.

On the other hand, packable resin composites have high filler content. Hence, they are more viscous and less adherent to handling instruments. This formula helped professionals to use amalgam techniques for placement of composite and produce acceptable interproximal contact**.** Moreover, the low polymerization shrinkage of packable composites may improve marginal adaptability ***(Leinfelder et al, 1998; Afflek et al, 1999).***

So it is of prime importance to evaluate the influence of load and thermal cycling and the use of flowable resin composite liners on the marginal sealing of class II packable resin composite restorations.

Studies are still pointing to microleakage as the major cause of restoration failure ***(Eakle et al, 1990).*** The initial polymerization shrinkage of composites may lead to separation of the resin from the preparation wall and the formation of gaps ***(Tjan et al, 1992).*** The low modulus of elasticity of resin composites also contributes to micro movements of the restorations under stress, subsequent failure of the mechanical bond, and eventually microleakage ***(Lundin et al, 1991).*** Furthermore, the difference in coefficients of thermal expansion and contraction of tooth and resin composites can lead to different volumetric changes in the resin and the tooth structure ***(Momoi et al, 1990).***

To improve the marginal sealing of resin composite restorations, many clinical techniques have been tested. These include incremental packing techniques ***(Tjan et al, 1992)*** and various modifications to the light curing modes ***(Lutz et al, 1986)***. The use of a low modulus lining material such as glass ionomer ***(Aboushala et al, 1996),*** resinous liners ***(Kakaboura et al, 1996)*** or new- generation dentin bonding agents ***(Chan and Swift, 1994)*** has been purposed. However, these lining materials reduced but did not completely eliminate microleakage.

Flowable resin composites were introduced in late 1996 and were characterized by fluid injectability into cavities. The filler particle size is the same as that used for hybrid composites, but the volume content ranges between that of hybrid and microfill composite resins ***(Bayne et al, 1998)***. The use of flowable composite as a liner or increasing the number of adhesive layers was described by some authors like ***Christensen in 1997.*** The justification was in fact to create an elastic layer that can work like a shock absorber layer and thus help to compensate for the contraction stresses of the restorative composite. However ***Bayne et al in 1998*** reported that a flowable composite should be expected to shrink more and create more stresses in bonding agents during composite curing than the traditional. The relative importance of each of these parameters must be carefully investigated.

Jain and Belcher in 2000, compared the microleakage of class II resin composite restorations with flowable composite in the proximal box. They used fifty sound extracted human maxillary premolars. Class II cavities were prepared on each premolar and were assigned into five groups. Each preparation in the first four groups was lined first with a layer of one of four flowable composites (Aelite-Flo, Flow-It, Revolution and Ultra-Seal XI). The remaining portion of the preparation was restored with hybrid composite (Prodigy). The fifth group was kept as a control where the entire preparation was restored with hybrid (Prodigy). Then all teeth were subjected to 1000 thermo cycles from 5 to 55 degree C with one minute dwell time and 12 seconds transfer time. The teeth were sectioned mesiodistally after immersion in 2% of basic fuchsin and examined for dye penetration. Their results showed no statistically significant differences in microleakage scores among the four flowable resin composites used in the proximal boxes of class II preparations. Also, microleakage with any of the flowable composites was not different from the control where the hybrid resin composite alone was used to restore the preparations.

Chuang et al in 2001 studied the influence of a flowable composite lining on the marginal microleakage and internal voids in class II composite restoration. Forty-eight sound extracted human molars were prepared with class II cavities and randomly divided into four groups; Group I: Hybrid (Prodigy) composite material over flowable lining (Revolution). Group II: Hybrid (Prodigy) composite material only. Group III: Hybrid (Tetric ceram) over flowable lining (Tetric flow). Group IV: Hybrid (Tetric ceram) only. After thermocycling tests and die soaking, these teeth were sectioned.